CLAIMS

1. A copper alloy containing a second element that does not dissolve or scarcely dissolves in a solid solution state at room temperature, characterized in that the average grain size of this alloy is not more than 20 μm and in that the second element precipitates among crystal grains.

2. The copper alloy according to claim 1, characterized in that this copper alloy has a hardness of not less than 30 HRB, an electrical conductivity of not less than 85 IACS%, and a thermal conductivity of not less than 350 W/(m·K).

3. The copper alloy according to claim 1 or 2, characterized in that the second element is any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B).

4. The copper alloy according to any of claims 1 to 3, characterized in that this copper alloy is a material for wiring connectors or a material for welding electrodes.

5. A method of manufacturing a copper alloy, characterized in that the method comprises causing a second element that does not dissolve or scarcely dissolves in a solid solution state at room temperature to dissolve in a base-material metal (Cu) in a solid solution state, achieving crystal grain refinement by applying a strain equivalent to an elongation of not less than 200% to this material, and subjecting this material to aging treatment simultaneously with or after the application of this strain, thereby to promote precipitation of the second element among crystal grains.

6. The method of manufacturing a copper alloy according to claim 5, characterized in that the second element is any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B).

7. The method of manufacturing a copper alloy according to claim 5 or 6, characterized in that means for applying a strain to the material is any of extrusion, drawing, shearing, rolling and forging.

8. The method of manufacturing a copper alloy according to claim 7, characterized in that conditions for the extrusion are such that lateral extrusion is performed at a material temperature of 400 to 1,000°C, a die temperature of 400 to 500°C, and an extrusion speed of 0.5 to 2.0 mm/sec.

9. The method of manufacturing a copper alloy according to any of claims 5 to 8, characterized in that before a strain is applied to the material, the material is subjected to aging treatment beforehand.

10. A composite copper material in which a ceramic powder is dispersed in a copper matrix, characterized in that this composite copper material has a hardness of not less than 30 HRB, an electrical conductivity of not less than 85 IACS%, and a thermal conductivity of not less than 350 W/(m·K).

11. The composite copper material according to claim 10, characterized in that the ceramic powder is alumina or titanium boride.

12. The composite copper material according to any of claims 1 to 11, characterized in that this copper alloy is a material for wiring connectors or a material for welding electrodes.

13. The composite copper material according to any of claims 1 to 11, characterized in that this copper alloy is a material for connectors of electric vehicles.

14. A method of manufacturing a composite copper material, characterized in that the method comprises mixing a copper powder and a ceramic powder together, thereby to form a mixed powder as a primary shaped body, and applying a strain to this primary shaped body, thereby to form a secondary shaped body in which base material and ceramic particles are combined together with refined particle sizes.

15. The method of manufacturing a composite copper material according to claim 14, characterized in that the means for applying a strain is extrusion that is performed at a material temperature of not less than 400°C but not more than 1,000°C and a die temperature of not less than 400°C but not more than 500°C.

16. The method of manufacturing a composite copper material according to claim 14, characterized in that the primary shaped body is obtained by green compacting or by filling the mixed powder in a tube.

17. The method of manufacturing a composite copper material according to claim 14 or 15, characterized in that the average particle size of the ceramic powder is 0.3 to 10 μm, in that a strain applied to the primary shaped body is equivalent to an elongation of not less than 200%, in that the average particle size of a base material of the secondary shaped body to be obtained is not more than 20 μm, and in that the average particle size of ceramic particles is not more than 500 nm.

18. A method of manufacturing a composite copper material in which titanium boride is dispersed in a copper matrix, characterized in that the method comprises the steps [1] to [4] below:

[1] the step of mixing a copper powder, a titanium powder and a boron powder together, thereby to form a primary shaped body;

[2] the step of applying thermal energy to the primary shaped body, thereby causing the titanium powder and the boron powder to react with each other in order to form titanium boride in a copper matrix; and

[3] the step of applying a strain to the primary shaped body in which the titanium boride is formed by plastically deforming the primary shaped body, thereby to form a secondary shaped body.

19. The method of manufacturing a composite copper material according to claim 18, characterized in that the secondary shaped body is subjected to heat treatment in the same step as the step of applying a strain by plastic deformation or a step following this step.

20. The method of manufacturing a composite copper material according to claim 18 or 19, characterized in that the plastic deformation involves applying a strain equivalent to an elongation of not less than 200%.

21. The method of manufacturing a composite copper material according to any of claims 18 to 20, characterized in that the plastic deformation is extrusion that is performed at a material temperature of not less than 400°C but not more than 1000°C.

22. The method of manufacturing a composite copper material according to any of claims 18 to 20, characterized in that the plastic deformation is extrusion that is performed at a die temperature of not less than 400°C but not more than 500°C.

23. The method of manufacturing a composite copper material according to any of claims 18 to 22, characterized in that the primary shaped body is obtained by green compacting or by filling a mixed powder in a tube.

24. The method of manufacturing a composite copper material according to any of claims 18 to 23, characterized in that the average particle size of the ceramic powder is 0.3 to 10 μm in that the average particle size of a base material of the secondary shaped body to be obtained is not more than 20μm, and in that the average particle size of titanium boride particles is not more than 500 nm.